Computer-Supported Afterlife: Near Future or Far Cry for Human Race

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Nenad Petrović

Abstract – This paper deals with questions of artificial computing device consciousness, after brain information is uploaded and stored into it (but the procedure of achieving "brain upload" is not taken into account). The goal is to provide an answer whether these actions could hypothetically provide some kind of posthuman afterlife – can person be still conscious of her/himself after being transferred at the current state of art. Generally, arguments are based on computation theory, combined with discussion on physical limitations and potential usage of quantum computers that are still in early development phase. At the current state of art, it is concluded that computational limits prevent this from being possible. The key is finding more powerful computational model than Turing machine. Also, the potential consequences, together with legal, social and ethical issues are discussed.

I. INTRODUCTION

Centuries ago, first computational machines were mechanical and their task was quite simple compared to computers available now – they were used to automatize process of simple arithmetic operations. Later, more and more complex from mathematical domain were solved using these machines.

In 1930s, revolution in this field happened: theory of computation was born and theoretical foundation of computer science were becoming more and more complete. Concept of Turing machine has been introduced together with Church's thesis determining the limit of computational power and capabilities of universal computers constructed this way [3]. This concept still holds as a main concept today and is considered as a theoretical limit for computational power in computer science. In other words, universal computing machine's computational power is bounded by the power of Turing machine.

Soon after that, in 1950s there comes another set of questions related to these machines. Can these artefacts somehow show intelligent behavior as humans do? Is it possible to make them think as humans do and make conclusion based on their knowledge. The field called Artificial Intelligence was born and started its development.

However, many questions come to our minds - can these machines think and do they really understand what they do or they just apply a set of rules in order to give the answer without any understanding? Turing test [2] and Chinese room argument [3] are significant thought experiments dealing with such questions.

In modern days, computer hardware technologies inconceivable in terms of speed, power and low price decades ago are becoming reality (Moore's law). Artificial intelligence and its sub-fields are becoming more and more complex – the age of Big Data has begun and enormous amount of information is being processed every moment in order to extract knowledge from it. But, we should recall that since the beginning of the modern computer era, human had visions of constructing artefacts which are able to act exactly like humans, and even have life after death in form of such machine. Many blockbusters from last four decades presented us different kinds of robots which are able to act like human – but even have emotions and in some cases.

So, at the current state of art, the question is – are we going to be able to construct machines soon? Is current development of computer science enough for this or the solution of this problem is only present in science fiction movies?

Many philosophers, visioners, futurists and transhumanists[1] tried to predict and give us some kind of answer in recent past. Ray Kurzweil, one of the most influential visioners of the modern times, states that, by 2050, we will be able to upload our brains and later use their data for different purposes. Iranian transhumanist known as FM-2030 stated that it could be possible in 2030.

These years are closer and closer to our reality. This is one of the reasons why this topic is becoming more and more relevant and interesting today.

II. PROBLEM STATEMENT

In this section, the problem that is going to be discussed is formulated – going from more general questions towards more concrete which can be explained by existing models and knowledge more precisely.

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[1] Transhumanism [4] is an international and intellectual movement dealing with transforming the human condition by developing and creating widely available sophisticated technologies to greatly enhance human intellectual, physical, and psychological capacities. The most common transhumanist thesis is that human beings may eventually be able to transform themselves into different beings with abilities so greatly expanded from the natural condition - called "posthuman" beings.

The formulation of our question could be restructured as: “Even if we have mind uploading possible, is it really a way to achieve eternal life?”

Let us assume that brain, as something which physically exists can be scanned and information can be somehow modelled, transferred and stored into computing device.

Next, the problem of intentionality appears – do we, by storing all the information from the brain, still have the intentionality of the person who owned that brain or we just have some raw data representing the brain information. Is modelling the brain structure of the person enough to achieve functions representing this person’s mind – such as behavior, intentions and emotions. Let us recall that mental processes are results of many different biological phenomena – such as hormones. They do affect our intentionality and behavior to a certain level.

In what follows, assumptions taken as a starting point are going to be presented.

First, let us also assume that we can also model the hormones behavior and simulate it somehow in near future. Also, assume that we can also model some other internal and external factors that can cause intentionality – like health condition, environment conditions and so on. With current development of technology it doesn’t seem impossible at first sight. So, let us assume that we somehow achieved the brain uploading and modeled all the phenomena that could affect the intentionality of the person that is being transferred to a computer.

And then, after finishing this procedure (not dealing with how is it going to be performed and how long does it last) – we decide to somehow test whether we achieved our goal – did we really successfully have all the conditions to provide someone an eternal life outside her/his body and is this the same person at all? Is, by transferring mind, also the consciousness of the person transferred?

Let us consider a thought experiment where we have two entities – one of them is a human, another one is its computer-based counterpart.

Computer-based counterpart is actually a computer which contains this person’s brain information (achieved by brain uploading) and executes application which uses the information provided in order to be as conscious as person is.

Now, we are interested in giving some kind of justification which could lead us to conclusion if it is possible that the computer is as conscious as the corresponding person or not.

In what follows, arguments based on two different approaches are going to be provided.

III. Computation Theory Approach

In this section, computation theory arguments are provided in order to find an answer to the questions from the problem statement.

Let us consider these two entities as two different Turing machines related to these two physical computers (one of them is human, another is computer).

The first one, representing the human is denoted as M_x and the second, which represents the computer executing program is M_y. Consciousness is considered as a function which is executed by corresponding Turing machine. We would like to know if the computer performing that function can be somehow conscious of the other Turing machine performing exactly the same function (the human being observed). Illustration is given in Fig. 1.

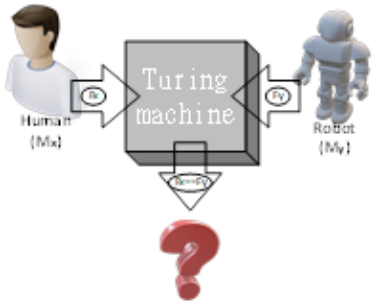

Fig. 1. Problem statement illustration from computation theory perspective.

The dual question is: can we construct Turing machine M_z also performed by the computer, that can give us answer if the functions being executed by Turing machines denoted previously as M_x and M_y are the same [5]?

Here, we recognize the program equivalence problem from the computation theory [1]. It is formulated as: does Turing machine M_x compute function that constitutes the set $F=\{f_y\}$. From computation theory, it is known that Turing machine which gives the answer if two Turing machines (M_x, M_y) calculate the same function doesn’t exist – so this problem is unsolvable in domain of Turing machines.

We can also make a bit different question – is there a such Turing machine which tells us if program P solves specified problem, or, in domain of Turing machines – does M_x compute the function that constitutes the set $F=\{f\}$? The answer is no (known as program correctness problem in computation theory) [1].

Now, knowing that such Turing machine doesn’t exist, we are interested in finding an alternative. There are many questions - Is there anything else that could solve this problem? - Which problems can be solved by computers? - Can we solve any problem we want somehow, or there are some limitations? - Is there any way to overcome these limitations?

Relying on Church’s thesis , which states that there is no any computational model which is solvable by mechanic device that is more powerful than the Turing machine itself, we can conclude that this problem is unsolvable by computer (because it is not solvable by Turing machine), which is a kind of mechanic device

considered in this case. At the current state of art – the Church's thesis still holds and the problem previously considered is unsolvable by any mechanic device.

The solution to the problem would be providing more powerful computational model than the Turing machine – which is not likely to happen soon. If it happens, it would be as revolutionary as the invention of the computing machines or even more and would give us ability to solve by reduction a large amount of problems which would make our life completely different.

It could, for example lead to development of extremely accurate prediction real-time systems which could be used in everyday life – from weather forecast to betting and playing lottery. Most of the decision-making problems could become trivial and easy to solve. Also, the more powerful computational model could bring us many difficulties – our information could become less secure or even not secure at all, because these models will be able to execute password-breaking activities extremely quickly compared to methods used today (brute force, for example).

Looking at possible benefits and consequences and knowing the nature of world and humanity – even if such model is developed, this is not going to happen soon nor it is going to be publicly available, because it could be considered dangerous. Such powerful computational model could completely change the current virtues and values in human society.

However, what about Moore's law? Can we just sit, relax, rely on Moore's law and wait for the revolution to happen? The answer is definitely no. Let us remember what is Moore's law about. It states that the number of transistors in a dense integrated circuit doubles every two years. Considering this prediction, we could ask ourselves does it mean that we are each year a step closer to achieving this goal. It will give us ability to construct faster and more powerful devices, which are more compact at the same time, but it doesn't have to do anything with the computational power – we will still have the same universal Turing machines implemented inside our computers and smartphones, which cannot solve new problems. They could be only more convenient to use, but they won't be able to bring us revolution which is be necessary in order to achieve the previously stated goal.

Taking into account all the things stated in this chapter, we can conclude that humanity is still far away from computer-based eternal life, when it comes to computational theory. Turing machines are upper bound of the computational power performed by any kind of mechanical device. There is direct relationship between computer algorithm and Turing machines. So, it is necessary to find more powerful model than Turing machine which would give us ability to solve problems that are not algorithmically solvable (as consciousness is).

If we consider an algorithm as something that could be explicitly explained by human being (using language, symbols, diagrams, for example), we can conclude that consciousness doesn't belong to this category, as it still cannot be precisely explained or defined.

Human's effective intelligence is not limited to problems solvable by Turing machines. Mechanical devices are actually capable to solve only a subset of the problem solvable by humans. Humans are also able to solve problems relying on intuition, which could be compared to the highest (infinite) level of heuristics which is not able to be achieved by any mechanical computing device. Consciousness definitely belongs to this category of problems – it is something that is extremely easy to be performed by humans, but still unreachable by computers.

IV. PHYSICAL AND QUANTUM COMPUTING APPROACH

In previous section, it was concluded that current computational power is limited and not enough for achieving the eternal life by such devices.

But, in this chapter, the problem is going to be analyzed from the different standpoint – physical limitations and potential usage of quantum computers. In recent years, quantum computing is very interesting topic. The question is if and how these kinds of computers could lead us to our goal.

It is assumed that both human beings and mechanical devices obey to law of physics (so called "physical symbol systems" [6]). If we assume that consciousness is something that obeys to laws of physics – we could think that having a quantum computer executing function of somebody's consciousness is the solution that would actually work. Could we have the same consciousness present in two different places at the same time – person's body and quantum computer? An illustration is given in Fig. 2.

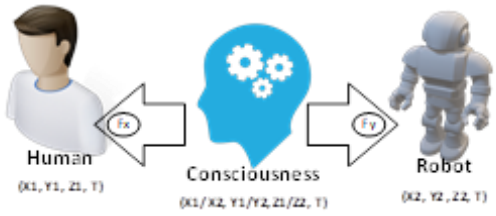

Fig. 2. Problem statement illustration from physical approach perspective.

Quantum computing studies theoretical computation systems that make direct use of quantum-mechanical phenomena to perform operations on data. Whereas typical digital computer uses the data encoded into binary digits (bits) – each of them is in one of two definite states (0 or 1), quantum computation uses quantum bits (qubits), which can be in superpositions of states [7]. Quantum computers share theoretical similarities with non-deteriministic and probabilistic computers. Large-scale quantum computers would theoretically be able to solve certain problems much

more quickly than classical computers [7]. However, several more facts should be taken into account. As of today, the development of actual quantum computers is still in its infancy. One of the most important facts – quantum computation does not violate the Church – Turing thesis, which means that given sufficient computational resources a classical computer, in theory, could be made to simulate any of the quantum algorithms.

So, we still didn't increase the computational power. Quantum computers may be able to efficiently solve problems which are very difficult for classical computers within a reasonable amount of time [6]. In other words – this model is more suitable for some kinds of problems, but doesn't give us ability to solve new, previously unsolved problem, as the one stated before (Turing machine which gives us the answer if two machines execute the same function).

Recalling once again the computational theory – non-deterministic Turing machine isn't more powerful than the deterministic one. It could be more efficient and suitable for problems from certain domains, but obeys to same computational limitation laws (Church's thesis). So, quantum computers are still in early development stage and share the same limitations in terms of computational power as classical computers and they are not the solution.

V. Social, ethical and legal issues

It is concluded that afterlife achieved this way is still not possible, but we must not forget about social, ethical and legal issues which may rise in opposite case.

In computational theory it is possible to solve problems by reduction. So, solving one of the currently unsolvable problems would lead to solution to many other unsolvable problems with is likely to completely change our perception of space and time.

For example, even the most powerful cryptography algorithms could have been broken within a moment. Bank accounts could be easily hacked. It is also obvious that cryptocurrencies would lose any sense in such conditions.

However, even more serious questions related to human existence rise. Who is going to be owner of someone's digital life counterpart? What if someone doesn't want to be transferred to a computer after death, is there are any way to prevent it? Is person living like this still responsible for his/her behavior and actions in terms of legal acts? How many ways to misuse the previous facts actually exist? These and countless many questions can be posed with no clear answer, which makes us still hope that this won't happen in near future and that consciousness is unique biological phenomena which cannot be simulated or performed by any kind of other computational device than the human being itself.

Taking into account the previously stated problems – we could conclude that this kind of innovation could potentially bring us more problems than true benefits.

VI. Conclusion

Due to computational and physical limitations previously stated, computer-based afterlife utilizing the brain information that is modeled and uploaded into computing device is still not possible nor it is likely that is going to be performed in near future.

The key is in breaking the computational limits stated by Church's thesis, or in other words – finding computational model more powerful than the Turing machine [1, 2].

Ability to solve such kind of problems could be considered as "Holy Grail" – it would lead human society, virtually, a step closer to something that is perceived as God, which means unlimited control and prediction power of anything happening. At the current state of art, computer-based after life is still in domain of science fiction and imagination. But, it doesn't mean that we won't be able to see more and more "intelligent" devices in near future. It is not likely that we will meet real "cyborgs" or "androids" similar, but it is certain that „small robots" or „assistants" integrated into different forms of digital devices (smart home, car, mobile phone, etc.) being able to deal with repetitive and boring tasks that could make our lives easier and more comfortable are becoming reality.

On the other side, if breaking of the computational limit happens one day, it would bring us more struggles than benefits considering all the possible consequences, problems and issues that could rise in such conditions which would dramatically affect our perception of life and previously established systems of values and virtues.

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